



[Technical Links](#) > [Health Guidelines](#) > [Chloroacetaldehyde](#)

Disclaimer: These guidelines were developed under contract using generally accepted secondary sources. The protocol used by the contractor for surveying these data sources was developed by the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the Department of Energy (DOE). The information contained in these guidelines is intended for reference purposes only. None of the agencies have conducted a comprehensive check of the information and data contained in these sources. It provides a summary of information about chemicals that workers may be exposed to in their workplaces. The secondary sources used for supplements 111 and 1V were published before 1992 and 1993, respectively, and for the remainder of the guidelines the secondary sources used were published before September 1996. This information may be superseded by new developments in the field of industrial hygiene. Therefore readers are advised to determine whether new information is available.

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR CHLOROACETALDEHYDE

INTRODUCTION

This guideline summarizes pertinent information about chloroacetaldehyde for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine whether new information is available.

SUBSTANCE IDENTIFICATION

* Formula

$C(2)H(3)ClO$

* Structure

For Structure, see paper copy)

* Synonyms

Chloroethanal, chloroacetaldehyde (40 percent aqueous), chloro-1-ethanal, chloroethanal, monochloroacetaldehyde, chloroacetaldehyde, chloroaldehyde

* Identifiers

1. CAS No.: 107-20-0

2. RTECS No.: AB2450000

3. DOT UN: 2232 55

4. DOT label: Poison

* Appearance and odor

Chloroacetaldehyde is a clear, colorless liquid with a pungent odor. The odor threshold for chloroacetaldehyde is less than 1 part per million (ppm) parts of air.

CHEMICAL AND PHYSICAL PROPERTIES

* Physical data

1. Molecular weight: 78.5
2. Boiling point (at 760 mm Hg): 85 degrees C (185 degrees F)
3. Specific gravity: 1.19 at 20 degrees C (68 degrees F) (40 percent solution)
4. Vapor density (air = 1): 2.7 (40 percent solution)
5. Melting point: -16.3 degrees C (2.66 degrees F) (40 percent solution)
6. Vapor pressure at 45 degrees C (113 degrees F): 100 mm Hg (40 percent solution)
7. Solubility: Soluble in water, ether, acetone, and methanol; at aqueous concentrations above 50 percent, it forms an insoluble hemihydrate.
8. Evaporation rate: Data not available.

* Reactivity

1. Conditions contributing to instability: Exposure to heat, sparks, and open flames should be avoided. The anhydrous substance polymerizes on standing but reverts to the monomer on distillation.
2. Incompatibilities: Contact between chloroacetaldehyde and oxidizers or acids may cause fire or explosion. The compound reacts with water to form a hydrate with the release of heat.
3. Hazardous decomposition products: Toxic gases and vapors such as chlorine, carbon monoxide, and carbon dioxide may be released when chloroacetaldehyde undergoes thermal decomposition.
4. Special precautions: None reported.

* Flammability

The National Fire Protection Association has not assigned a flammability rating to chloroacetaldehyde. Other sources rate chloroacetaldehyde's fire hazard as moderate.

1. Flash point: 88 degrees C (190 degrees F) (closed cup) (40 percent solution)
2. Autoignition temperature: Data not available.
3. Flammable limits in air: Data not available.
4. Extinguishant: For small fires use dry chemical, water spray, or regular foam. Use water spray, fog, or regular foam to fight large fires involving chloroacetaldehyde.

Fires involving chloroacetaldehyde should be fought upwind from the maximum distance possible. Keep unnecessary people away; isolate the hazard area and deny entry. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Containers of chloroacetaldehyde may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool fire exposed containers from the sides with water until well after the fire is out. Stay away from the ends of containers. Dike fire control water for later disposal; do not scatter this material. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving chloroacetaldehyde.

EXPOSURE LIMITS

* OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for chloroacetaldehyde is 1 ppm (3 milligrams per cubic meter (mg/m³)) as a ceiling limit. A worker's exposure to chloroacetaldehyde shall at no time exceed this ceiling level [29 CFR 1910.1000, Table Z-1].

* NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for chloroacetaldehyde of 1 ppm (3 mg/m³) as a ceiling limit [NIOSH 1992].

* ACGIH TLV

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned chloroacetaldehyde a ceiling limit value of 1.0 ppm (3.2 mg/m³), which should not be exceeded during any part of the working exposure [ACGIH 1994, p. 16].

* Rationale for Limits

The NIOSH limit is based on the risk of throat, nose, and lung irritation, severe eye irritation, and skin burns [NIOSH 1992].

The ACGIH limit is based on the risk of severe irritation [ACGIH 1991, p. 261].

HEALTH HAZARD INFORMATION

* Routes of Exposure

Exposure to chloroacetaldehyde can occur through inhalation, ingestion, eye or skin contact, and absorption through the skin [Sittig 1991; Hathaway et al. 1991].

* Summary of toxicology

1. Effects on Animals: Chloroacetaldehyde is a severe eye, skin, and upper respiratory tract irritant in experimental animals. A 30 percent solution of chloroacetaldehyde applied to the skin or eyes of rabbits produced severe damage [Hathaway et al. 1991]. It is extremely toxic in animals. Chloroacetaldehyde is reported to be mutagenic in bacterial test systems, but has not been found to be carcinogenic [ACGIH 1991]. The oral LD(50) for rats is 75 mg/kg and the dermal LD(50) for rabbits is 224 mg/kg [NIOSH 1990; Sax and Lewis]. When rats were injected daily with 0.3 or 0.6 of the LD (50) dose for 30 days, 25 and 67 percent, respectively, of the animals died [Clayton and Clayton 1982]. Rats, guinea pigs, rabbits, and mice repeatedly exposed to 1.6 ppm chloroacetaldehyde by inhalation for 7 hours/day, 5 days/week for 6 months did not show adverse effects [ACGIH 1991]. At a concentration of 5 ppm, however, nasal and eye irritation occurred and growth was retarded in male rats [ACGIH 1991].

2. Effects on Humans: Chloroacetaldehyde is a severe irritant of the eyes, mucous membranes, skin, and respiratory tract in humans. A 40 percent solution presents a serious hazard to the eye, and direct contact could result in tissue damage and permanent impairment of vision [ACGIH 1991]. Contact of the skin with a 40 percent solution can result in a burn-like injury [Parmeggiani 1983]. A 0.1 to 0.5 percent solution is capable of causing irritation if the exposure is prolonged or repeated [ACGIH 1991; Parmeggiani 1983].

* Signs and symptoms of exposure

1. Acute exposure: Acute exposure causes irritation of the eyes, mucous membranes, respiratory tract, and skin. Skin burns, eye damage, and sensitization of the skin and respiratory tract may also occur. Severe cases may develop into pulmonary edema

[Sittig 1991].

2. Chronic exposure: No signs or symptoms of chronic exposure to chloroacetaldehyde have been reported in humans. However, any concentration level of chloroacetaldehyde causing even a slight irritation in humans may be potentially injurious on subsequent exposures [ACGIH 1991].

EMERGENCY MEDICAL PROCEDURES

* Emergency medical procedures: [NIOSH to supply]

5. Rescue: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the Material Safety Data Sheet required by OSHA's Hazard Communication

Standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve chloroacetaldehyde and lead to worker exposures to this substance:

- * The manufacture and transportation of chloroacetaldehyde
- * Use in manufacture of 2-aminothiazole and as a chemical intermediate in the production of other compounds
- * Use as algicide, bactericide, fungicide, and preservative
- * Use as a spinning solution of poly B-alanine
- * Use to facilitate bard removal from tree trunks

Methods that are effective in controlling worker exposures to chloroacetaldehyde, depending on the feasibility of implementation, are as follows:

- * Process enclosure
- * Local exhaust ventilation
- * General dilution ventilation
- * Personal protective equipment

Workers responding to a release or potential release of a hazardous substance must be protected as required by paragraph (q) of OSHA's Hazardous Waste Operations and Emergency Response Standard [29 CFR

Good sources of information about control methods are as follows:

1. ACGIH [1992]. Industrial ventilation--a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. Industrial ventilation--a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.
5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL SURVEILLANCE

OSHA is currently developing requirements for medical surveillance. When these requirements are promulgated, readers should refer to them for additional information and to determine whether employers whose employees are exposed to chloroacetaldehyde are required to implement medical surveillance procedures.

* Medical Screening

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace, such measures. To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, periodically during the term of employment, and (3) at the time of job transfer or termination.

* Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to chloroacetaldehyde, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, and respiratory system. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society.

A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to chloroacetaldehyde at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the eyes, skin, or respiratory system.

* Periodic medical evaluations

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to chloroacetaldehyde exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of chloroacetaldehyde on the eyes, skin, or respiratory system. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

* Termination medical evaluations

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

* Biological monitoring

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for chloroacetaldehyde.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne chloroacetaldehyde is made using a silica gel tube (520/260 mg sections, 20/40 mesh). Samples are collected at a maximum flow rate of 0.5 liter/minute (ceiling) for a minimum collection time of 15 minutes. The sample is then treated with acetonitrile. Analysis is conducted by gas chromatography using an electron capture detector (GC/ECD). This method (OSHA 76) is described in the OSHA Computerized Information System and is fully validated. NIOSH Method No. 2015 (chloroacetaldehyde) also relies on GC/ECD analysis, but uses flow rates ranging from 0.05 to 0.2 liters/minute [NIOSH 1994b].

PERSONAL HYGIENE PROCEDURES

If chloroacetaldehyde contacts the skin, workers should flush the affected areas immediately with plenty of water, followed by washing with soap and water.

Clothing contaminated with chloroacetaldehyde should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the hazardous properties of chloroacetaldehyde, particularly its potential for causing severe irritation.

A worker who handles chloroacetaldehyde should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, applying cosmetics, or taking medication.

Workers should not eat, drink, use tobacco products, apply cosmetics, or take medication in areas where chloroacetaldehyde or a solution containing chloroacetaldehyde is handled, processed, or stored.

STORAGE

Chloroacetaldehyde should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's Hazard Communication Standard [29 CFR 1910.1200]. Containers of chloroacetaldehyde should be protected from physical damage and moisture, and should be stored separately from oxidizers or acids.

SPIILLS AND LEAKS

In the event of a spill or leak involving chloroacetaldehyde, persons not wearing protective equipment and fully-encapsulating, vapor-protective clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

1. Notify safety personnel.
2. Remove all sources of heat and ignition.
3. Ventilate potentially explosive atmospheres.
4. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
5. Use non-sparking tools.
6. Water spray may be used to reduce vapors, but the spray may not prevent ignition in closed spaces.
7. For small liquid spills, take up with sand or other absorbent material and place into

closed containers for later disposal.

8. For large liquid spills, build dikes far ahead of the spill to contain the chloroacetaldehyde for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

* Emergency planning requirements

Chloroacetaldehyde is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) (Title III) in 42 USC 11022.

* Reportable quantity requirements for hazardous releases

A hazardous substance release is defined by EPA as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of contaminated containers) of hazardous substances. In the event of a release that is above the reportable quantity for that chemical, employers are required to notify the proper Federal, State, and local authorities [40 CFR

The reportable quantity of chloroacetaldehyde is 1,000 pounds. If an amount equal to or greater than this quantity is released within a 24-hour period in a manner that will expose persons outside the facility, employers are required to do the following:

Notify the National Response Center immediately at (800) or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].

* Community right-to-know requirements

Employers are not required by EPA in 40 CFR Part 372.30 to submit a Toxic Chemical Release Inventory form (Form R) to EPA reporting the amount of chloroacetaldehyde emitted or released from their facility annually.

* Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24.

Under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA has specifically listed many chemical wastes as hazardous. Chloroacetaldehyde is listed as a hazardous waste under RCRA and has been assigned EPA Hazardous Waste No. P023. This substance has been banned from land disposal until treated by incineration.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (703) 412-9810 (in the Washington, D.C. area) or toll-free at (800) 424-9346 (outside Washington, D.C.). In addition, relevant State and local authorities should be contacted for information on any requirements they may have for the waste removal and disposal of this substance.

RESPIRATORY PROTECTION

* Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of chloroacetaldehyde exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should only use respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

* Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's Respiratory Protection Standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the latest edition of the NIOSH Respirator Decision Logic [NIOSH 1987b] and the NIOSH Guide to Industrial Respiratory Protection [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Workers should use appropriate personal protective clothing and equipment that must be carefully selected, used, and maintained to be effective in preventing skin contact with chloroacetaldehyde. The selection of the appropriate personal protective equipment (PPE) (e.g., gloves, sleeves, encapsulating suits) should be based on the extent of the worker's potential exposure to chloroacetaldehyde. There are no published reports on the resistance of various materials to permeation by chloroacetaldehyde.

To evaluate the use of PPE materials with chloroacetaldehyde, users should consult the best available performance data and manufacturers' recommendations. Significant differences have been demonstrated in the chemical resistance of generically similar PPE materials (e.g., butyl) produced by different manufacturers. In addition, the chemical resistance of a mixture may be significantly different from that of any of its neat components.

Any chemical-resistant clothing that is used should be periodically evaluated to determine its effectiveness in preventing dermal contact. Safety showers and eye wash stations should be located close to operations that involve chloroacetaldehyde.

Splash-proof chemical safety goggles or face shields (20 to 30 cm long, minimum) should be worn during any operation in which a solvent, caustic, or other toxic substance may be splashed into the eyes.

In addition to the possible need for wearing protective outer apparel (e.g., aprons, encapsulating suits), workers should wear work uniforms, coveralls, or similar full-body coverings that are laundered each day. Employers should provide lockers or other closed areas to store work and street clothing separately. Employers should collect work clothing at the end of each work shift and provide for its laundering. Laundry personnel should be informed about the potential hazards of handling contaminated clothing and instructed about measures to minimize their health risk.

Protective clothing should be kept free of oil and grease and should be inspected and maintained regularly to preserve its effectiveness.

Protective clothing may interfere with the body's heat dissipation, especially during hot

weather or during work in hot or poorly ventilated work environments.

REFERENCES

ACGIH [1991]. Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

ACGIH [1994]. 1994-1995 Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

ATS [1987]. Standardization of spirometry -- 1987 update. American Thoracic Society. Am Rev Respir Dis

CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

Clayton G, Clayton F [1981-1982]. Patty's industrial hygiene and toxicology. 3rd rev. ed. New York, NY: John Wiley & Sons.

DOT [1993]. 1993 Emergency response guidebook, guide 55. Washington, DC: U.S. Department of Transportation, Office of Hazardous Materials Transportation, Research and Special Programs Administration.

Genium [1986]. Material safety data sheet No. 586. Schenectady, NY: Genium Publishing Corporation.

Hathaway GJ, Proctor NH, Hughes JP, and Fischman ML [1991]. Proctor and Hughes' chemical hazards of the workplace. 3rd ed. New York, NY: Van Nostrand Reinhold.

Lewis RJ, ed. [1993]. Lewis condensed chemical dictionary. 12th ed. New York, NY: Van Nostrand Reinhold Company.

Lide DR [1993]. CRC handbook of chemistry and physics. 73rd ed. Boca Raton, FL: CRC Press, Inc.

Mickelsen RL, Hall RC [1987]. A breakthrough time comparison of nitrile and neoprene glove materials produced by different glove manufacturers. Am Ind Hyg Assoc J 941-947

Mickelsen RL, Hall RC, Chern RT, Myers JR [1991]. Evaluation of a simple weight-loss method for determining the permeation of organic liquids through rubber films. Am Ind Hyg Assoc J 445-447

NIOSH [1987a]. NIOSH guide to industrial respiratory protection. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-116.

NIOSH [1987b]. NIOSH respirator decision logic. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-108.

NIOSH [1990]. Registry of toxic effects of chemical substances: Chloroacetaldehyde. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Standards Development and Technology Transfer, Technical Information Branch.

NIOSH [1992]. Recommendations for occupational safety and health: Compendium of policy documents and statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 92-100.

NIOSH [1994a]. NIOSH pocket guide to chemical hazards. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-116.

NIOSH [1994b]. NIOSH manual of analytical methods. 4th ed. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-113.



[Back to Top](#)

www.osha.gov

www.dol.gov

[Contact Us](#) | [Freedom of Information Act](#) | [Customer Survey](#)
[Privacy and Security Statement](#) | [Disclaimers](#)

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210